WHAT IS CLAIMED IS:

1. A microplate for a microarray assay device, comprising a plurality of discrete array formation areas each formed of a flexible material and activated for immobilization of biorecognition materials, and barriers formed between the array formation areas to restrict fluid cross-flow therebetween.

2. The microplate of claim 1, wherein the barriers are walls formed of the flexible material, hydrophobic patches, troughs, gaskets, or pedestals formed between the array formation areas.

3. The microplate of claim 1, wherein the barriers have a height of less than about 4 mm.

4. The microplate of claim 1, comprising a tray formed of the flexible material, the tray having a plurality of discrete wells formed therein, each well containing an array formation area at its bottom.

5. The microplate of claim 1, comprising a tray formed of the flexible material, the tray having a peripheral depression surrounding one or more array formation areas.

6. The microplate of claim 1, comprising a support plate, a flat substrate formed of the flexible material disposed over the support plate, and a gasket defining a plurality of holes, the gasket being disposed over the substrate and sealed thereto, where each area of the substrate exposed by a hole of the gasket contains an array formation area.

7. The microplate of claim 1, further comprising a rigid frame detachably attached to the flexible material.

8. The microplate of claim 7, further comprising a plurality of rigid hangers, and a plurality of well strips formed of the flexible material, each well strip being pressed-fitted into a rigid hanger, each well strip containing one or more array formation areas.

9. The microplate of claim 1, further comprising a plurality of microarrays of biorecognition materials, each microarray being formed within an array formation area.

10. The microplate of claim 9, wherein the biorecognition materials include biomolecules, cells or cellular components.

11. The microplate of claim 9, wherein the biorecognition materials are labeled.

12. The microplate of claim 9, wherein each array contains from 1 to 1536 elements of biorecognition materials.

13. The microplate of claim 1, wherein the array formation areas are activated for immobilization of biorecognition materials by covalent interaction, noncovalent interaction or affinity interaction.

14. The microplate of claim 1, where the array formation areas are activated by direct surface treatment, placement of activated inserts, or adsorption of an activated coating to the surface of the areas.

15. The microplate of claim 1, wherein the flexible material is a thermal formable polymer material and the microplate is formed by vacuum forming or injection molding.

16. The microplate of claim 1, wherein the flexible material has a thickness of about 0.1 to 100 mils.

17. The microplate of claim 16, wherein the flexible material has a thickness of about 1 to 10 mils.

18. The microplate of claim 1, wherein the flexible material has a flexural modulus (ASTM D790) of about 170-220 Ksi, a Shore D hardness (ASTM D 2240) of about 65-80, and a deflection temperature at 66 Psi of about 100-200°F.

19. The microplate of claim 1, further comprising a lid formed of a plurality of caps each corresponding to an array formation area.

20. The microplate of claim 19, wherein each cap comprises a gas inlet port, a gas outlet port, and a gas diffusion member disposed on an inside of the cap.

21. The microplate of claim 20, wherein each cap further comprises a temperature control element.

22. An assembly for a microarray assay device, comprising:

a microplate of claim 1;

a rigid frame attached to a periphery of the microplate; and

a vacuum fixture defining a top surface and an interior chamber connectable to a vacuum source, wherein the rigid frame is adapted for mounting the microplate on top of the vacuum fixture so that the array formation areas are supported on the top surface of the vacuum fixture, the vacuum fixture further defining a plurality of orifices connected to the interior chamber and opening at the top surface at locations corresponding to the array formation areas when the microplate is mounted on the top surface of the vacuum fixture via the rigid frame.

23. The assembly of claim 22, wherein the vacuum fixture further comprises a temperature control device for controlling the temperature of the top surface of the vacuum fixture.

24. The assembly of claim 23, wherein the temperature control device includes a plurality of channels formed in the vacuum fixture in the vicinity of the top surface for passing a temperature-controlled fluid.

25. The assembly of claim 22, further comprising a peristaltic pump connected to the interior chamber for generating an alternating positive and negative pressures within the interior chamber, whereby the alternating positive and negative pressures are conducted by the orifices to the top surface of the vacuum fixture at locations corresponding to the array formation areas to create a micromixing effect.

26. A microarray assay method, comprising:

providing a microplate comprising a plurality of discrete array formation areas each formed of a flexible material and activated for immobilization of biorecognition materials, and barriers formed between the array formation areas to restrict fluid cross-flow therebetween;

mounting the microplate on a top surface of a vacuum fixture, the vacuum fixture having a plurality of orifices connected to a vacuum source and opening at the top surface of the vacuum fixture at location corresponding to the array formation areas of the microplate;

generating a negative pressure in the orifices to hold the array formation areas against the top surface of the fixture; and

while holding the array formation areas against the top surface of the fixture, performing at least one function selected from the group consisting of: printing a microarray of biorecognition materials in an array formation area, adding a sample to an array formation area, controlling the temperature of any sample added in the array formation area, and imaging an array formation area.

27. A microarray assay method, comprising:

providing a microplate comprising a plurality of discrete array formation areas each formed of a flexible material and activated for immobilization of biorecognition

materials, and barriers formed between the array formation areas to restrict fluid cross-flow therebetween;

mounting the microplate on a top surface of a vacuum fixture, the vacuum fixture having a plurality of orifices connected to a vacuum source and opening at the top surface of the vacuum fixture at location corresponding to the array formation areas;

adding at least one sample to at least one array formation area; and

generating alternating positive and negative pressures in the orifices to move the array formation areas up and down to mix the sample.

28. The method of claim 27, wherein at least one array formation area contains an array of immobilized biorecognition materials.

29. The method of claim 28, wherein the biorecognition materials are labeled.

30. The method of claim 28, wherein the sample is labeled.